Chemistry: *Stoichiometry – Problem Sheet 1*

Directions: *Solve each of the following problems. Show your work, including proper units, to earn full credit.*

1. Silver and nitric acid react according to the following balanced equation:

$$3\ Ag(s)\ +\ 4\ HNO_3(aq)\ \rightarrow\ 3\ AgNO_3(aq)\ +\ 2\ H_2O(l)\ +\ NO(g)$$

   A. How many moles of silver are needed to react with 40 moles of nitric acid?

   B. From the amount of nitric acid given in Part A, how many moles of silver nitrate will be produced?

   C. From the amount of nitric acid given in Part A, how many moles of water will be produced?

   D. From the amount of nitric acid given in Part A, how many moles of nitrogen monoxide will be made?

2. Given the balanced equation: $2\ N_2H_4(l)\ +\ N_2O_4(l)\ \rightarrow\ 3\ N_2(g)\ +\ 4\ H_2O(g)$

   A. How many moles of dinitrogen tetrahydride are required to produce 57 moles of nitrogen?

   B. How many moles of dinitrogen tetroxide are required to produce 57 moles of nitrogen?

   C. How many moles of water are produced when 57 moles of nitrogen are made?

3. Calculate the mass of aluminum oxide produced when 3.75 moles of aluminum burn in oxygen.

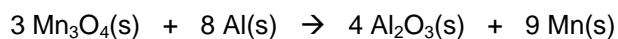Answers: 1A. 30 mol Ag   1C. 20 mol H_2O 2A. 38 mol N_2H_4 2C. 76 mol H_2O
   1B. 30 mol $AgNO_3$ 1D. 10 mol NO   2B. 19 mol N_2O_4 3.   191 g Al_2O_3

4. At a very high temperature, manganese is isolated from its ore, manganomanganic oxide, via the following balanced equation:

$$3\ Mn_3O_4(s)\ +\ 8\ Al(s)\ \rightarrow\ 4\ Al_2O_3(s)\ +\ 9\ Mn(s)$$

A. How many manganese atoms are liberated if 54.8 moles of Mn_3O_4 react with excess aluminum.

B. How many moles of aluminum oxide are made if 3580 g of manganomanganic oxide are consumed?

C. How many moles of manganomanganic oxide will react with 5.33×10^{25} atoms of aluminum?

D. If 4.37 moles of aluminum are consumed, how many molecules of aluminum oxide are produced?

5. Camels store the fat tristearin ($C_{57}H_{110}O_6$) in the hump. Besides being a source of energy, the fat is a source of water for the camel because when the fat is burned, the following reaction occurs:

$$2\ C_{57}H_{110}O_6(s)\ +\ 163\ O_2(g)\ \rightarrow\ 114\ CO_2(g)\ +\ 110\ H_2O(l)$$
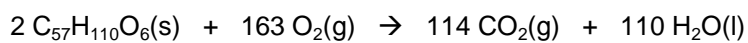
A. At STP, what volume of oxygen is required to consume 0.64 moles of tristearin?

B. At STP, what volume of carbon dioxide is produced in Part A?

C. If 22.4 L of oxygen is consumed at STP, how many moles of water are produced?

D. Find the mass of tristearin required to produce 55.56 moles of water (about 1 liter of liquid water).

Answers: 4A. 9.9×10^{25} atoms Mn   4C. 33.2 mol Mn_3O_4 5A. 1168 L O_2 5C. 0.675 mol H_2O
            4B. 20.9 mol Al_2O_3 4D. 1.3×10^{24} m'cules Al_2O_3 5B. 817 L CO_2 5D. 899 g $C_{57}H_{110}O_6$